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Typographic enhancement of multiword units in second language text

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This study examines the effect of typographic enhancement on L2 learners' intake of multiword units from reading. EFL learners read texts in one of three versions: (1) with many multiword units underlined; (2) with half of these multiword units underlined; and (3) without any underlining. The learners were subsequently asked to identify the multiword units they remembered encountering in the texts. The purpose of the text version in which only half of the target units were underlined was to explore whether enhancement of a small number of word strings in a text also stimulates intake of others from that text. As expected, enhanced multiword units were remembered better than unenhanced ones, but there was no evidence that the benefit extended beyond the enhanced items.

Keywords: collocations, formulaic expressions, textual enhancement, attention, reading, adult language learning

Cette étude s'intéresse à l'effet, chez des lecteurs en langue seconde, d'une mise en relief typographique sur la mémorisation d'expressions lexicales. Les participants sont confrontés à l'une de ces trois versions d'un texte en anglais: (a) la première où certaines expressions lexicales sont soulignées, (b) la deuxième où seulement la moitié de ces expressions sont soulignées, (c) et la troisième où aucune n'est soulignée. Ultérieurement, les apprenants sont invités à identifier les expressions qu'ils se souviennent avoir rencontrées dans le texte. L'objectif de la deuxieme version du texte est d'examiner si la mise en évidence de quelques expressions peut avoir un effet bénéfique sur la mémorisation d'autres expressions au sein d'un même texte. Notre étude confirme que la mémorisation des expressions soulignées est supérieure à celle des expressions non-soulignées. Par ailleurs, la deuxième version du texte ne révèle aucun impact positif sur la mémorisation des expressions non-soulignées

Palabras clave: collocation, expressions formulaiques, mise en relief du texte/des mots, attention, lecture, apprentissage des langues par adultes

Introduction

The past two decades have seen a growing recognition of the role of multiword lexis in discourse and language acquisition, including second (or foreign) language acquisition (e.g. Nattinger and DeCarrico 1992; Lewis 1993, 1997, 2000; Wray 2002; Schmitt 2004; Hoey 2005; Meunier and Granger 2008; Boers and Lindstromberg 2009; Barfield and Gyllstad, 2009; Wood 2010a, 2010b; Polio

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2012). We shall use *multiword unit* (henceforth MWU) here as an umbrella term for conventional word strings which have in the literature been referred to by a panoply of terms, including formulaic sequences, idiomatic expressions, lexical phrases, phrasal expressions, lexical bundles, chunks, and prefabs (Wray 2002; Martinez and Schmitt 2012). Knowledge of multiword units has been shown to be one of the hallmarks of native speaker competence (e.g. Pawley and Syder 1983; Conklin and Schmitt 2008; Ellis, Simpson-Vlach, and Maynard 2008), and it has also been shown to be positively associated with proficiency in a second language (e.g. Boers et al. 2006; Siyanova-Chanturia, Conklin and Van Heuven 2011; Sonbul 2015). Unfortunately, research suggests that acquisition of this dimension of a second or foreign language tends to be very slow and to lag behind acquisition of single words (e.g. Forsberg 2010; Laufer and Waldman 2011; Li and Schmitt 2010; Peters 2014).

Two broad explanations have been put forward for this slow rate of acquisition. One is that, while formulaicity at large is ubiquitous in language (e.g. Sinclair 1991; Erman and Warren 2000), most individual MWUs are not highly frequent. Apart from a small number of high-frequency formulas (e.g. Shin and Nation 2008), one and the same MWU is unlikely to be encountered repeatedly in a short span of natural discourse (e.g. Boers and Lindstromberg 2009; Byrd and Coxhead 2010), and frequency of encounters is one of the factors known to influence the likelihood of incidental vocabulary acquisition (e.g. Webb 2007; Chen and Truscott 2010). The second explanation is that, during natural meaning-focused processing, learners are not very likely to pay attention to the characteristics of a phrase when it consists of familiar words and is semantically transparent. Many applied linguists now concur that intake requires attention or 'noticing' (Schmidt 1990, 2001). If learners are familiar with 'have' and 'a dream', then encountering *I had a dream* during a meaning-focused activity is probably not going to prompt them to contemplate the lexical makeup of this phrase (even though it may be non-congruent with the counterpart in their L1, as would be the case if the learners' L1 were French – *j'ai fait un rêve* ['I made a dream'] –, for example). The learning challenge, in such cases, is to take in and remember the appropriate syntagmatic word partnership, or collocation, and to overcome negative transfer from the mother tongue (e.g. Nesselhauf 2005; Yamashita and Jiang 2010; Wolter and Gyllstad 2011).

A growing number of teaching materials as well as materials for independent study with a distinct focus on various kinds of MWU have become available in recent years (e.g. McCarthy and O'Dell 2002, 2003, 2005, 2008; Lindstromberg and Boers 2008; Davis and Kryszewska 2012). It needs to be acknowledged, however, that the effectiveness of most of these proposed materials and study procedures still needs to be put to the test in empirical research (e.g. Boers et al. 2014). In any case, given the sheer size of the lexicon, including its phrasal dimension, it is clear that the challenge of mastering this cannot be met through explicit teaching or deliberate study alone (Nation 2013: 92). A substantial portion of learning will therefore need to occur as a by-product, so to speak, of activities where the learner engages first and foremost with

communicative content. Authentic texts offer exposure to contextualized use of MWUs and are thus a potential source for incidental MWU acquisition.

Given the aforementioned issues around learners' noticing of phrases, however, it is nevertheless worth exploring ways of directing learners' attention to the MWUs they encounter in textual input. Learners can be guided by their teacher to identify MWUs in the texts they are reading in the classroom (e.g. Boers et al. 2006; Jones and Haywood 2004), but steps to stimulate intake from texts that learners read independently, outside the language classroom, would also be welcome. One of the obstacles in this regard is that a given MWU will usually need to be encountered (and noticed) several times for a learner to distinguish it from more incidental word combinations (Hoey 2005; Eyckmans et al. 2007). A one-off meeting or even the off-chance re-encounter with a given word string provides insufficient evidence for the learner to conclude it is a conventionalised expression and worth adding to her repertoire, after all. A possible means of tackling this problem is textual enhancement.

Textual enhancement can come in several forms. One is to 'flood' a text with instances of the same MWUs. The effectiveness of this method was investigated by Webb, Newton and Chang (2013), who incorporated multiple instances of the same MWUs (e.g. *break the silence*; *pull strings*) in short stories constituting about 35 minutes of reading (accompanied by an audio-recording of the stories). As expected, the greater the number of encounters with the targeted MWUs, the better the learners' retention of these tended to be. It needs to be conceded, however, that inserting multiple instances of the same expression in a text requires a fair amount of resourcefulness on the part of the materials developer. An alternative manipulation to make selected MWUs salient in a text is the use of visual or typographic enhancement, for example by underlining or bolding the phrases. Even though a given MWU may occur just once in an authentic text, the typographic enhancement can serve to signal to the learner that it is a word string worth attending to. It is this latter intervention that is the object of the present study.

Previous research on the effects of typographic enhancement

Many studies on textual enhancement have explored its usefulness for grammar acquisition. Following Sharwood-Smith's (1993) proposal to lend salience to grammar forms in the input that would otherwise tend to go unnoticed by learners, several researchers have compared learners' uptake of selected forms from enhanced texts and un-enhanced texts (Leow 2001; Izumi 2002; Lee 2007; Winke 2013; Jahan and Kormos 2015; LaBrozzi 2016, for relatively recent examples). These studies typically combine input flood (i.e. multiple instances of the target form) and typographic (or visual) enhancement (e.g. bolding of the instances). Results have been very mixed, and a meta-analysis by Lee and Huang (2008) suggests that, altogether, the effect on acquisition tends to be small (also see Han, Park and Combs 2008, for a review).

In the realm of vocabulary acquisition, typographic enhancement is also typically used in conjunction with input flooding (e.g. Rott 2007), but complemented by clarifications of the enhanced words' meaning either in the text itself (e.g. Kim 2006) or added in glosses (e.g. Ko 2012; Jung 2016). In the latter case, the typographic enhancement signals to the reader that a gloss is available (e.g. Hulstijn, Hollander and Greidanus 1996; Watanabe 1997; Laufer and Hill 2000; De Ridder 2002; Bishop 2004; Peters, Hulstijn, Sercu and Lutjeharms 2009). Obviously, typographic enhancement alone cannot be expected to elucidate word meaning. However, it may at least draw the reader's attention to the occurrence of a lexical item and thus to its form. In the case of MWUs, 'form' includes lexical composition (e.g. *have a nightmare*, not 'make a nightmare'). In short, typographic enhancement may be a relatively fruitful intervention when it is used with the express purpose of fostering knowledge of collocation (i.e. standardly co-occurring words).

Two studies (Sonbul and Schmitt 2013; Szudarski and Carter 2014) have shown that typographic enhancement combined with input flooding leaves stronger memory traces of collocation than input flooding alone. In addition, Peters (2009, 2012) reports evidence that the combination of typographic enhancement and glossing aids retention. One of the questions addressed in Peters (2012) was whether the enhancement of MWUs in a text might have an awareness-raising effect that prompts learners to take notice of other MWUs in the text beyond those which have been made salient. No evidence of such an effect was found. This is discouraging, because raising learners' awareness of the formulaic makeup of texts has been advocated as a way of accelerating learner-autonomous acquisition of multiword lexis (e.g. Lewis 1997). The present study therefore re-examines the chances that the effect of enhancement might extend to learners' intake of MWUs beyond the ones that are actually enhanced.

Research questions

We view acquisition of collocation from reading as an incremental process, whereby each encounter with a word combination has the potential to contribute to the combination's gradual entrenchment in memory (e.g. Hoey 2005). In keeping with Sharwood-Smith (1993) and Schmidt (2001), among others, we consider this contribution to gradual entrenchment to be mediated by attentional processes – that is, 'noticed' instances of a given word combination will make a greater contribution than unnoticed ones. It is in this context that we evaluate the usefulness of typographic enhancement, i.e. its role in making items salient and thus more likely to leave an imprint (at least temporarily) on the learner's episodic memory. Whether or not an MWU encountered in a text has been temporarily 'taken in' by the learner in this sense will be operationalized here as the learner's ability to identify the MWU, in a post-test, as one they have previously encountered in a given reading text.

The questions we seek answers to are as follows:

1. Does typographic enhancement of MWUs foster their intake?
2. Does typographic enhancement of MWUs foster intake of other MWUs from the text beyond those that are enhanced?

Method

The experimental study we set up to address the above questions was conducted twice, using identical sets of materials and near-identical procedures. In both trials, EFL learners were randomly assigned to one of three reading conditions. In all three reading conditions the same texts were used, but in one condition a relatively large number of MWUs were underlined in the texts, in a second condition only half of these MWUs were underlined, and the third reading condition had no underlining. The purpose of the second condition was to investigate research question two, i.e. whether enhancement of some MWUs affects learners' intake of other, non-enhanced, MWUs occurring in the reading text.

Participants

As mentioned, we conducted the experiment twice. In both trials, the participants were English majors at universities in the Flemish part of Belgium. This is a region where people are exposed to English on a daily basis, mostly through British, American and Australian TV programmes, films, pop music, computer games, and (other) English-medium entertainment on the internet. The participants all shared Dutch as L1 (and some were raised bilingually, but not in English).

The participants in the first trial ($N = 38$) were nearing the end of their first term of training at university. Their ages ranged from 18 to 21. They had all taken English courses (3 or 4 class hours per week) at secondary school for five years. Their English programme at university comprised six class hours per week of English in the first term. The participants in the second trial ($N = 43$) were English majors (aged 20 to 23) nearing the end of the second term of their third year of training at university, a continuation of the same studies as the participants in trial one. Also these students had had English courses at secondary school (3 or 4 class hours per week) for five years, followed by their more intensive English programme at university for close to three years.

Both trials took place during one of the students' regular courses. In both trials the participants were randomly assigned to one of the three reading conditions. For logistic reasons, a simple between-participant design was opted for rather than a counter-balanced design, where each participant would have undergone all three different treatments. To verify whether the random assignment to conditions in each trial created groups that were equivalent in terms of English proficiency, we compared the students' end-of-term English exam grades (see further below). These exams consisted of tests gauging knowledge of grammar and vocabulary as well receptive and productive communicative skills.

Materials and procedure

Two texts, one adapted from a report on the *BBC* website about the link between food and cognition (http://news.bbc.co.uk/2/hi/uk_news/education/4342636.stm) and the other adapted from an article in *Scientific American* about the link between music and cognition (http://www.scientificamerican.com/article/hearing-the-music-honing/), served as reading materials. The original texts were adapted by trimming them to about 400 words each. To ensure these texts would not pose comprehension problems due to a high proportion of unfamiliar vocabulary, we ran them through the lexical profiler at http://www.lextutor.ca/vp/. The lexical load of the texts was found to be relatively light: receptive knowledge of the 3,000 most frequent word families of English suffices to 'cover' 95% of the running words of the texts; knowledge of the 4,000–5,000 most frequent word families of English suffices to cover 98%. Texts with this kind of vocabulary profile correspond to the easy end of what Nation (2014) calls mid-frequency readers. Much authentic (and yet non-technical) reading in English requires knowledge of 8,000–9,000 word families to reach 98% coverage (Nation 2006). Given the profile of the participants in our study, we felt confident the two selected texts were well within these students' reading competence.

Per text, 16 MWUs, each occurring once, were selected as targets. The online British National Corpus (BNC) and the Corpus of Contemporary American English (COCA) were consulted to ascertain that these were indeed conventional word strings. Like the lexis in the texts overall, the vast majority of the chosen MWUs were made up of members of the 3,000 most frequent word families in English (exceptions were: *junk* food, *fizzy* drinks, current *craze* and *sheer* joy).

The target MWUs included verb-noun collocations (e.g. *conduct an experiment*), adjective-noun collocations (e.g. *full impact*), nominal compounds (e.g. *junk food*), and prepositional phrases (e.g. *cause for concern*; *amount to*). We realise that MWUs may vary in the way they are processed (e.g. Columbus 2010) as well as in their memorability (e.g. Peters 2016). Given our between-participant design, this inter-item variability applies across the three reading conditions, however. Including as targets MWUs of diverse kinds is also ecologically realistic, since pedagogic proposals for directing learners to MWUs in authentic texts (e.g. Lewis 1997) use broad utility criteria rather than a focus on a particular type of MWU. Besides, research suggests that presenting learners with sets of same-type MWUs (e.g. verb-noun collocations) increases the risk of inter-item interference and may not be advisable (Boers et al. 2014).

Three versions of the two texts were created. In version A, all 16 selected MWUs in each text were underlined; in version B only half of these (every other one) were underlined; and in version C, none were underlined. (See Appendix 1 for version A of the two texts.). Version C thus serves as a control (or baseline) condition against which to weigh the effect of enhancement.

In the trial with the 1st year English majors, the text about food and cognition was handed out first. The students were given five minutes to read it, and they

were told questions about it would follow. However, no further information was given about the nature of these questions. The text was then collected by the researcher and the test was handed out. The first part (see Appendix 2) consisted of four true/false statements concerning text content. This created a brief interlude of a few minutes between the reading activity and the part that followed next. That subsequent, principal part of the test (see Appendix 3), which students were given five minutes to complete, gauged their recognition of the MWUs included in the text they had just read. MWUs encountered in the text were juxtaposed to a synonymous phrase, and the task for the students was to identify the wording they remembered seeing in the text. As the students were asked to try and recall which of the phrases they had met in the previously read texts, this is an *episodic* memory task (Tulving 1993), i.e. remembering an item in conscious association with the (con)text where it was encountered. Per test item, a 'neither (a) or (b)' response option was provided as well, to reduce blind guessing. This was the correct response for two of the 16 test items.

After the students' test sheets had been collected, the text about music and cognition was handed out, again with the instruction to read the text (in five minutes) with a view to answering questions about it. Given the prior test experience following the first reading text, the students were now more likely to expect questions not just about the content of the text but also about its wording. If so, this might prompt the participants in condition B (in whose text version only half of the target MWUs were underlined) to extend their attention to MWUs in the text beyond the underlined ones. Again, four true/false questions were given as a brief interlude, followed by the test on the 16 MWUs encountered in the text, using the same format as before.

In developing the MWU recognition tests, we made an effort to create plausible 'lures' by verifying in corpora (COCA and BNC) that the proposed synonymous phrases were conventional ones. An effort was also made to strike a balance between test items where the target MWU was the more frequent phrase according to the corpus data and ones where the synonym was, resulting in a ratio of 17/15. Appendix 4 lists the corpus frequencies of the target MWUs and their synonyms.

The materials and procedure for the second trial, with the 3rd year English majors, were identical to the first trial, with one exception: the order of the texts was reversed (i.e. the text about music and cognition was given first). This was done to evaluate the effect (if any) of test anticipation – whether anticipating a verbatim recognition test stimulates intake of MWUs regardless of typographic enhancement. If such an effect were to occur, it should occur regardless of which text is read first.

Analysis

To assess the overall effect of reading condition on verbatim memory for MWUs, we applied ANOVAs to the three groups' scores on the MWU recognition tests. We also ran 3 × 2 factor ANOVAs on the MWU recognition scores, separating the

MWUs that were typographically enhanced only in condition A but not in B from the MWUs that were enhanced in both conditions A and B. Recall that version C had no enhancement. Given that an important part of the study (research question 2) explores whether awareness-raising induced by enhancement promotes intake of wording beyond what is actually enhanced, we are particularly interested in the outcome of reading condition B (where only half of the target phrases were underlined). If the effect is confined to the enhanced phrases only, this should show up in the 3×2 ANOVA as a significant interaction between reading condition and item set (underlined vs. not underlined).

Results

Trial 1

We shall refer to the group that read version A of the texts (i.e. with all MWUs enhanced) as group A ($n = 13$), the group that read version B (i.e. with half of the MWUs enhanced) as group B ($n = 13$), and the group that read version C (i.e. no enhancement) as group C ($n = 12$). According to their end-of-year English exam grades, the three groups were comparable, with mean grades (on 20) of 11.15 (SD 3.24), 12.38 (SD 4.33) and 11.17 (SD3.95), respectively. One-way ANOVA yields $F(2, 35) = 0.43$; $p = 0.65$. Also the performance on the eight true/false content questions used in the experiment indicates that the three groups comprehended and took in the content of the texts to the same degree, with mean scores of 6.31 (SD 1.18), 6.46 (SD 1.13) and 6.17 (SD 1.27) ($F(2, 35) = 0.19$; $p = 0.83$). Given these combined indications that the three groups were similar in English proficiency and text comprehension, any pronounced differences on the MWU recognition tests are likely to be attributable to the differing reading conditions which the students were assigned to. The descriptive statistics for the three groups' scores on the MWU recognition tests are presented in Table 1.

A one-way ANOVA on the three groups' total mean test scores signals a significant between-group difference: $F(2, 35) = 3.47$; $p = .042$. The difference lies between group A (all enhanced) and group C (no enhancement): $t(23) = 2.59$; $p = 0.016$; Cohen's $d = 1.08$. Although group B (half enhanced) does not outperform group C (no enhancement) significantly when it comes to the total score, group B does perform particularly well on the items which were enhanced in their text ($M = 12.08$), and outperforms group C ($M = 8.17$) on these, with a very large effect size: $t(23) = 3.55$; $p = 0.002$; Cohen's $d = 1.48$. The data thus indicate that, when MWUs are enhanced in a text, this gives these enhanced items a better chance of being recognized afterwards. The descriptive statistics in Table 1 hint at the possibility that this effect is greatest when only a small number of items is enhanced: The small set of MWUs that was enhanced in text version B generated better scores under that reading condition than in condition A, where twice as many items were enhanced. On the downside, the set of MWUs left *un*enhanced in version B generated poorer test scores under that reading condition than in condition C, where nothing was enhanced. These

Table 1 Mean scores (and standard deviations) on the MWU recognition tests, trial 1

Reading Condition	Recognition of targets enhanced in versions A and B			Recognition of targets enhanced only in version A			Total score (max = 32)
	Text 1	Text 2	Total	Text 1	Text 2	Total	Both texts
A: All targets enhanced ($n = 13$)	4.85 (1.21)	5.85 (1.57)	**10.69** (2.43)	5.31 (1.60)	5.15 (1.41)	**10.46** (2.26)	**21.15** (3.63)
B: Half of the targets enhanced ($n = 13$)	5.85 (1.28)	6.23 (1.96)	**12.08** (2.87)	4.31 (1.11)	4.46 (1.98)	**8.7** (2.24)	**20.85** (4.43)
C: No targets enhanced ($n = 12$)	3.67 (0.98)	4.50 (2.32)	**8.17** (2.62)	5.08 (1.44)	4.17 (1.53)	**9.25** (2.14)	**17.42** (3.58)

between-group differences fall short of significance, though, and should thus not be over-interpreted.

The 3 × 2 factor ANOVA reveals a significant interaction between reading condition and set of target MWUs (i.e. underlined vs. not underlined in condition B): $F(2) = 5.38$, $p = 0.007$), confirming that enhancement benefited the enhanced items in condition B, but not the other items. A paired *t*-test shows the enhanced items in text version B were significantly better recalled than the non-enhanced ones under this reading condition: $t(12) = 4.54$; $p = 0.0007$; Cohen's $d = 1.29$. This difference between the two item sets is not observed in conditions A and C, which suggests that the two item sets were matched rather well as far as their 'intrinsic' memorability is concerned.

In short, while the results of trial 1 show that typographic enhancement renders enhanced MWUs relatively memorable, there is no evidence that any awareness-raising about multiword lexis that might have been effected by the underlining of a small number of phrases resulted in greater intake of other phrases encountered in the texts.

We felt it worth including a breakdown of the test scores for the two texts separately in Table 1, in case the students' anticipation of the second MWU recognition test (forewarned by their prior test experience after reading the first text) altered their reading behaviour, possibly resulting in increased allocation of attention to non-enhanced MWUs. There is little evidence of this in the test data. Although the mean scores calculated across the three groups were slightly higher (by 0.43) in the second test, the gap between students' test performance on enhanced vs non-enhanced items remains. The difference in mean score between groups A (all enhanced) and C (no enhancement) is 1.41 in test 1 and 2.33 in test 2; the difference between the mean scores on enhanced vs non-enhanced items within group B is 1.54 in test 1 and 1.77 in test 2.

Trial 2

The three participant groups in the second trial (which we shall call groups A, B and C again, corresponding to text versions A, B and C, respectively) were comparable in English proficiency, as gauged by the students' end-of-year English exams. The mean exam grades were 12.33 (SD 1.63) for group A ($n = 15$), 11.93 (SD 2.09) for group B ($n = 14$) and 11.93 (SD 2.16) for group C ($n = 14$). One-way ANOVA yields $F(2, 40) = 0.21$; $p = 0.81$. No between-group differences were attested on the true/false tests concerning text content either, with mean scores of, respectively, 7.13 (SD 0.83), 7.14 (SD 0.66) and 7.50 (SD 0.65) ($F(2, 40) = 1.18$; $p = 0.32$). The descriptive statistics of the MWU recognition test results of the second trial are summed up in Table 2.

While the test scores are higher overall than in the first trial – a likely reflection of the higher proficiency of the participants – the between-condition comparisons yield roughly analogous results. One-way ANOVA applied to the total scores shows a significant between-group difference: $F(2, 40) = 9.74$; $p = 0.0004$. Group A (all enhanced) significantly outperforms both groups C (no enhancement) *and*

Table 2 Mean scores (and standard deviations) on the MWU recognition tests, trial 2

Reading Condition	Recognition of targets enhanced in versions A and B			Recognition of targets enhanced only in version A			Total score (max = 32)
	Text 1	Text 2	Total	Text 1	Text 2	Total	Both texts
A: All targets enhanced ($n = 15$)	6.73 (1.03)	6.53 (0.99)	**13.27** (1.75)	5.93 (1.22)	7.20 (0.68)	**13.13** (1.13)	**26.40** (1.99)
B: Half of the targets enhanced ($n = 14$)	6.50 (1.16)	6.79 (0.80)	**13.29** (2.87)	4.79 (0.80)	5.29 (1.64)	**10.07** (2.09)	**23.36** (4.43)
C: No targets enhanced ($n = 14$)	6.00 (0.78)	5.43 (1.50)	**11.43** (1.40)	4.71 (0.99)	6.21 (1.31)	**10.93** (1.64)	**22.36** (2.65)

B (half enhanced). Independent-samples *t*-tests produce: $t(27) = 4.67$ ($p < 0.0001$; Cohen's $d = 1.78$) and $t(27) = 3.22$ ($p = 0.003$; Cohen's $d = 0.93$), respectively. Group B (half enhanced) does not significantly outperform group C (no enhancement) with respect to total scores, but it does so when it comes to the subset of MWUs which were underlined in group B's texts (means: B = 13.29; C = 11.43): $t(27) = 3.08$; $p = 0.005$; Cohen's $d = 0.85$. In short, the data again show consistent evidence that typographic enhancement of MWUs in a text helps to leave an imprint of these enhanced items in learners' episodic memory.

As to the question of whether the attention given to underlined MWUs extends to other MWUs in the texts, the data again fail to show positive evidence of this. In fact, group B's score on the subset of MWUs which was left unenhanced in their version of the texts is the lowest ($M = 10.07$), with group A ($M = 13.13$) outperforming group B significantly on these items, with a very large effect size: $t(27) = 4.95$; $p < 0.0001$; Cohen's $d = 1.91$. The comparatively poor performance by group B on the items that were left unenhanced in that reading condition is reflected also in the outcome of the 3×2 factor ANOVA, which again reveals a significant interaction between reading condition and set of target MWUs (i.e. underlined vs. non-underlined in condition B): $F(2) = 7.37$; $p = 0.001$. A paired samples *t*-test confirms that the enhanced items in condition B were significantly better remembered by these learners than the non-enhanced items: $t(13) = 4.96$; $p = 0.0002$; Cohen's $d = 1.28$. This better performance on one subset of target items over the other is not paralleled in the other two participant groups.

Given the particularly poor performance by group B on the set of MWUs which were not underlined in their text, one may wonder if the small number of enhanced items usurped attention at the cost of others (see Barcroft 2003, for evidence of this phenomenon in the context of deliberate word learning). If this were the case, then group C's performance on the items left unenhanced in version B should be better. The descriptive statistics in Table 2 suggest this is the case – and this is analogous to what we found in the first trial. However, the difference falls short of significance also in this second trial, and so any claims about a possible 'trade-off' effect in attention allocation between enhanced and non-enhanced MWUs needs to stay speculation for now. What the data do allow us to infer is that enhancement benefits intake of enhanced MWUs, but that this benefit does not extend to other, non-enhanced MWUs in the same text.

Recall that the order of the texts was reversed in this trial (and so text 1 in Table 2 corresponds to text 2 in Table 1). The breakdown of test scores per text helps to examine the possibility of whether anticipation of a verbatim MWU recognition test alters learners' attention allocation, such that non-enhanced items stand a better chance of being remembered. The data show no compelling evidence of this. Although the total mean score calculated across the three groups is slightly higher (by 0.57) on the second test than the first, a considerable gap between the scores on enhanced and non-enhanced items remains. The difference in mean score between groups A (all enhanced) and C (no enhancement) is 1.95 in test 1 and 1.02 in test 2; the difference between the mean scores on enhanced vs non-enhanced items within group B is 1.71 in test 1 and 1.50 in test 2.

Conclusion

Overall, the study reported here supports the thesis that typographic enhancement benefits L2 learners' noticing of enhanced language forms. Formulaic language arguably lends itself rather well to this intervention, at least when it is applied with the modest intention of drawing learners' attention to the lexical makeup of formulaic word strings. This intervention is also relatively simple for teachers and materials developers to implement. Underlining as many as 16 MWUs per roughly 400 words of text (which amounted to underlining almost 12% of the running words of the texts) brought about better post-reading recognition of these phrases than a reading condition without any enhancement. This suggests that a fair amount of formulaic language can be highlighted without compromising the saliency effect that the enhancement creates. Still, it stands to reason there must be a point where excessive use of enhancement is bound to reduce the distinctiveness which the technique is meant to bestow on items.

One of the questions we addressed in our study was whether typographic enhancement of some MWUs might stimulate intake of the formulaic dimension of a text beyond the enhanced items only. This question is pertinent if typographic enhancement is to serve as an awareness-raising technique after which learners will increase their acquisition of MWUs from independent reading. Unfortunately, our data furnish no evidence that the benefits of enhancement 'spill over' to other, non-enhanced, word strings in the texts. It is actually striking that in both trials reported here, the mean test scores on the non-enhanced items were lower in condition B than in condition C, i.e. the control (or baseline) condition. As this difference fell short of statistical significance both times, it would certainly be premature to make any claims about a trade-off effect. Still, the observation seems to accord with a study by Barcroft (2003), in which participants were asked to memorize a list of novel words under different enhancement conditions. When a small number of words in the list were typographically enhanced, this created comparatively strong memory traces for precisely those words, but it did so at the cost of the unenhanced ones. Barcroft's study concerned the deliberate memorization of decontextualized words, which is quite different from the implementation of textual enhancement we examined the effect of in this article. Further research would be welcome to shed more light on the precise effects of typographic enhancement in the domain of reading. Such further endeavours could include partial and conceptual replications of the type of study reported here, but should also look into effects beyond the episodic memory stage and thus gauge the impact on learners' development of implicit or procedural knowledge of MWUs.

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Appendix 1: Reading texts, version A (16 phrases enhanced per text)

A recipe for school success

The poor nutritional quality of school meals has become an important issue and the government has set up a School Meals Review Panel to make recommendations. Recommendations made so far include the banning of junk food from school canteens and fizzy drinks from vending machines.

However, at a national conference on healthy eating in schools this week two major problems were highlighted: a lack of money to implement change and a need for more research.

There was a positive note. Research evidence suggests that if we crack the problem of poor nutrition amongst children, we may solve many of the problems of anti-social behaviour and poor learning.

That might seem a big claim but it came from an authoritative scientific source. Bernard Gesch, a researcher at Oxford University, made a presentation linking food to behaviour. His evidence is based on research he carried out, not in schools, but in prisons. This involved giving prisoners food supplements containing vitamins, minerals and essential fatty acids. The results were dramatic: the anti-social behaviours of those on the food supplements fell by over 35%. The most serious violent acts fell by even more.

Dr Alex Richardson of Oxford University conducted another experiment, involving young children, aged from six to 11. All these children had learning difficulties and were more than two years behind in reading and spelling. The experiment provided the children with supplements containing Omega-3 and Omega-6 fatty acids and vitamin E. Again, the results were very clear. The children improved their reading ability at more than three times the normal rate, and more than twice the rate in spelling, over three months of treatment. These are significant improvements.

So, the government would do good to channel funds into school children's diets. This brings us to the problem of money. The chair of the School Meals Review Panel, Suzi Leather, told the conference that the cost of implementing

nutrition standards in schools in England would amount to £500 m over three years. So far, the government has given only £220 m for that period.

The time table for introducing nutrition standards is another cause for concern. Due to the obstacles to be overcome, many school dinners may continue for several years to lack the nutritional content required for healthy living. This is serious, as we have not yet seen the full impact of poor diet on children's health. By 2020 it is estimated that one in five boys, and one in three girls, will be obese. That is not just overweight, but clinically obese.

Music and the mind

Nearly 20 years ago a small study advanced the notion that listening to Mozart's *Sonata for Two Pianos in D Major* could boost cognitive functioning. It was not long before "Mozart effect" products were sold to parents who wished to make their children more intelligent.

The evidence for a Mozart effect was actually weak, and the original study never claimed anything more than a temporary and limited effect. In recent years, however, neuroscientists have examined the benefits of a deliberate effort to study and practice music, as opposed to just playing a Mozart CD once in a while. Advanced monitoring techniques have enabled scientists to see what happens inside your head when you practice a musical instrument. They have found that music lessons can produce lasting changes that improve the general ability to learn. These results should convince public officials that music classes at school are useful.

Studies have shown that instrument training from an early age can help the brain to process sounds better, making it easier to stay focused when learning other subjects, from literature to mathematics. Children and teenagers who learn to play an instrument are better able to concentrate and less likely to be distracted. They can attend to several things at once, an essential skill for multi-tasking.

Learning music can also help children in learning a new language. The current craze in the West for learning Mandarin provides a good example. The difference between *mā* (a high, level tone) and *mà* (falling tone) represents the difference between "mother" and "scold." Musicians are better than non-musicians at picking out when your *mā* is *mà*ing you to practice.

Sadly, fewer schools are giving students an opportunity to learn an instrument. There is a disturbing decline of music education as part of the standard curriculum. For example, from 1999 to 2004 the number of students taking music classes in Californian public schools dropped by 50 percent.

The main reason for playing an instrument, of course, will always be the sheer joy of making music. But we should also be working to incorporate into the curriculum our new knowledge of its beneficial effect on the brain. Involvement with an instrument from an early age is an achievable goal even with limited resources. Music is not just an "extra."

Appendix 2: Questions about text content

According to the text 'A recipe for school success'…

1. An experiment carried out in prisons shows that limiting the prisoners' calorie intake helps reduce anti-social behaviour.

☐ True
☐ False

2. There is no scientific evidence yet to support the link between diet and learning.

☐ True
☐ False

3. Improving diet in school has been found to have a positive impact on pupils' mathematical skills.

☐ True
☐ False

4. The author thinks it is a pity that the new nutritional standards are not introduced sooner.

☐ True
☐ False

According to the text 'Music and the mind' …

1. There is strong evidence that listening to Mozart's music makes people smarter.

☐ True
☐ False

2. Children who practise an instrument tend to be better able to concentrate and multi-task.

☐ True
☐ False

3. In recent years, research has led the US education authorities to devote extra funding to music programmes in the school curriculum.

☐ True
☐ False

4. Practising an instrument can help language learners with sound discrimination.

☐ True
☐ False

Appendix 3: The MWU recognition tests (excerpts)

A number of phrases have been deleted from the text you have read. For each blank, choose on the answer sheet the phrase that you think occurred in the original text.

A recipe for school success

The poor nutritional quality of school meals has become an important issue and the government has set up a School Meals Review Panel to make recommendations. Recommendations made so far include the banning of _____1_____from school canteens and _____2_____from vending machines.

However, at a national conference on healthy eating in schools this week two major_____3_____: a lack of money to implement change and a need for more research.

[…]

The timetable for introducing nutrition standards is another _____14_____. Due to _____15_____, many school dinners may continue for several years to lack the nutritional content required for healthy living. This is serious, as we have not yet seen _____16_____ of poor diet on children's health.

Answer sheet

Gap	Answer a/	Answer b/	Answer c/
1	☐ junk food	☐ unhealthy food	☐ neither a nor b
2	☐ fizzy drinks	☐ soft drinks	☐ neither a nor b
3	☐ problems were highlighted […]	☐ problems were identified […]	☐ neither a nor b […]
14	☐ matter of debate	☐ cause for concern	☐ neither a nor b
15	☐ the problems to be overcome	☐ the obstacles to be overcome	☐ neither a nor b
16	☐ the full effect	☐ the full impact	☐ neither a nor b

Music and the mind

Nearly 20 years ago a small study _____ 1 _____ that listening to Mozart's *Sonata for Two Pianos in D Major* could boost cognitive functioning.

[…]

The main reason for playing an instrument, of course, will always be _____13_____ of making music. But we should also be working to incorporate into the curriculum our new knowledge of its _____14_____ on the brain. Involvement with an instrument from an early age is an _____15_____ even with _____16_____. Music is not just an "extra."

Answer sheet

Gap	Answer a/	Answer b/	Answer c/
1	☐ advanced the notion […]	☐ made the claim […]	☐ neither a nor b […]
13	☐ the pure pleasure	☐ the sheer joy	☐ neither a nor b
14	☐ beneficial effect	☐ positive impact	☐ neither a nor b
15	☐ an attainable objective	☐ an achievable goal	☐ neither a nor b
16	☐ limited resources	☐ tight budgets	☐ neither a nor b

Appendix 4: Corpus frequencies[a] of the target MWUs and their synonyms

Targets	COCA	BNC	'Lures'	COCA	BNC
Underlined only in version A of *A recipe for school success*					
fizzy drinks	17	27	soft drinks	1250	185
positive note	183	31	good news	8271	1191
big claim	23	2	far-fetched	784	34
results were dramatic	35	7	results were impressive	61	7
provided […] with	1132	527	supplied […] with	386	397
channel funds	29	10	inject money	12	6
cause for concern	478	196	matter of debate	93	22
the full impact	172	47	the full effect	80	23
Underlined in versions A and B of *A recipe for school success*					
junk food	647	64	unhealthy food	26	5
problems were highlighted	27	12	problems were identified	239	37
crack the problem	1	5	address the problem	781	82
made a presentation	238	18	reported findings	92	6
conducted an experiment	162	22	did an experiment	137	34
significant improvements	699	50	substantial improvements	130	23
amounts to	2243	575	is as much as	71	22
obstacles to be overcome	8	3	problems to be overcome	4	11
Underlined only in version A of *Music and the mind*					
the original study	115	11	the researchers	5097	374
as opposed to	7472	1665	rather than	62611	21320
lasting changes	82	1	long-term effects	749	24
stay focused	467	2	pay attention	7332	384
current craze	16	1	latest fad	52	10

Targets	COCA	BNC	'Lures'	COCA	BNC
dropped by	1197	209	fell by	568	539
beneficial effect	472	151	positive impact	224	21
limited resources	755	155	tight budgets	263	39
Underlined in versions A and B of *Music and the mind*					
advanced the notion	20	1	made the claim	140	36
examined the benefits	14	4	assessed the merits	17	9
once in a while	2816	105	every so often	844	176
studies have shown	1404	209	research has revealed	62	11
essential skill	135	19	key ability	2	2
disturbing decline	1	0	dramatic reduction	82	26
sheer joy	104	29	pure pleasure	105	17
achievable goal	62	9	attainable objective	4	4

[a]Corpus frequencies collected in October 2015.
[b]The frequencies of the ADJ-N and V-N collocations include their inflected forms (i.e. singular/plural and tense/aspect conjugations).

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